

The data reported in this paper are drawn from the Varela/Janerich case-control study of lung cancer in nonsmokers in New York. The Varela dissertation was completed in 1987; the data were published by Janerich, et al., in 1990, following the death of Dr. Varela.

RESPIRATORY DISEASES AND CONDITIONS -- ADULTS

- [37] "Asthma Related to Occupational and Ambient Air Pollutants in Nonsmokers," J.R. Greer, D.E. Abbey, and R.J. Burchette, *Journal of Occupational Medicine* 35(9): 909-915, 1993 [See Appendix A]

A cohort of 3,914 California Seventh-Day Adventists was studied for this report on adult asthma. The authors claim that workplace ETS exposure was statistically significantly associated with asthma risk in their population, as was airway obstructive disease before age 16, and ozone exposure (in men only).

RESPIRATORY DISEASES AND CONDITIONS -- CHILDREN

- [38] "Risk Factors for Acute Wheezing in Infants and Children: Viruses, Passive Smoke, and IgE Antibodies to Inhalant Allergens," A.L. Duff, E.S. Pomeranz, L.E. Gelber, G.W. Price, H. Farris, F.G. Hayden, T.A.E. Platts-Mills, and P.W. Heymann, *Pediatrics* 92(4): 535-540, 1993 [See Appendix A]

The authors of this study report that viral respiratory tract infections (particularly due to respiratory syncytial virus) are important risk factors for wheezing in children under the age of two, whereas viral infections (mostly rhinovirus) and sensitization to allergens are important risk factors in older children. They also claim that ETS exposure, as determined by cotinine levels, was common among all wheezing children in the study, but that high cotinine levels were "significantly more common" among children less than two years of age.

- [39] "Influence of Maternal Smoking on Variability of Peak Expiratory Flow Rate in School Children," T. Frischer, J. Kuhr, R. Meinert, W. Karmaus, and R. Urbanek, *Chest* 104(4): 1133-1137, 1993 [See Appendix A]

Based on a cohort study of over 1,200 German children, the authors report that variability in a measure of lung function was related to maternal smoking. They claim that this finding suggests that maternal smoking contributes to the development of childhood asthma.

- [40] "Environmental Tobacco Smoke and Asthma," S.T. Weiss, *Chest* 104(4): 991-992, 1993 [See Appendix A]

In this editorial published with the Frischer, et al., study of variability of lung function measurements in children, the author claims that maternal smoking is an important factor in the incidence and severity of childhood asthma.

ETS EXPOSURE AND MONITORING

- [41] "Children's Exposure to Parental Smoking in West Germany," H. Brenner and A. Mielck, *International Journal of Epidemiology* 22(5): 818-823, 1993 [See Appendix A]

The authors of this study report on the prevalence of maternal and paternal smoking in a sample of households surveyed in West Germany. Estimates of prevalence presented in the paper include, for paternal smoking, 33.7 percent for children less than two years of age, 43.1 percent for those ages two to five, and 46.8 percent for children ages six to 13. Estimates of the prevalence of maternal smoking ranged from 18.9 percent to more than 30 percent.

- [42] "Predicting Regional Lung Deposition of Environmental Tobacco Smoke Particles," W.W. Nazaroff, W.-Y. Hung, A.G.B.M. Sasse, and A.J. Gadgil, *Aerosol Science and Technology* 19: 243-254, 1993 [See Appendix A]

This paper reports on a methodology that incorporates several models in an attempt to predict respiratory tract particle deposition of ETS. The methodology uses

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particle size distributions, aerosol dynamics, and a lung deposition model to generate its conclusions.

INDOOR AIR QUALITY

- [43] "Assessment of an Ultraviolet Air Sterilizer on the Incidence of Childhood Upper Respiratory Tract Infections and Day Care Centre Indoor Air Quality," J.C. Dionne, J.C. Soto, and S. Pineau, *Indoor Environment 2*: 307-311, 1993 [See Appendix A]

The authors examined the use of ultraviolet light as a means of sterilizing the air in day care centers, as ultraviolet light is thought to have a germicidal action. Reportedly, although some decreases in the number of microorganisms occurred with the air treatment, the incidence of respiratory infections in the study children did not decrease, suggesting that transmission was not airborne, but rather, occurred by other means. The authors recommend adequate ventilation for day care centers.

- [44] "Air Quality Standards in Offices: Should They Be Health or Comfort Based?" F.W. Lunau, *Indoor Environment 2*: 213-216, 1993 [See Appendix A]

The author of this commentary suggests that office workers and industrial workers could be equally well-protected by adherence to industrial exposure limits. However, he comments that office workers' perceptions of comfort may affect economic costs, and suggests that office IAQ questions be addressed by "guidance rather than regulation."

- [45] "Examination of Sick Leave Absences from Work in Buildings with Various Rates of Ventilation," D.M. Rowe, S.E. Wilke, and L. Guan, *Indoor Environment 2*: 276-284, 1993 [See Appendix A]

Based upon data collected in seven Australian office buildings, none of which was "sick," the authors report that occupant sick leave absences were not related to the amount of ventilation provided. They suggest that other aspects of the indoor environment could be related to employee absenteeism, however.

IN EUROPE & AROUND THE WORLD

REGULATORY AND LEGISLATIVE MATTERS

AUSTRALIA

- [46] South Australia Contemplates Workplace Smoking Ban

Affecting some 74,000 workplaces, the South Australian (SA) government reportedly says it wants smoking bans in 95 percent of the state's workplaces by the year 2000. SA's Health Minister says that although the government is committed to reduce the total number of smokers by 20 percent by the year 2010, he would not further this commitment by making smoking illegal in the workplace. *See Adelaide Advertiser*, January 8, 1994.

- [47] Canberra Rejects Proposals to Prohibit Smoking in Public Places

Leaving the matter of smoking restrictions to its state governments, the Canberra Cabinet has rejected recommendations by the Commonwealth Health Minister to restrict cigarette advertising and prohibit smoking in public places. The Prime Minister, Sir Robert Menzies, reportedly will raise the recommendations relating to smoking restrictions with the state premiers. While Canberra has the authority to ban smoking on Commonwealth properties, it lacks the power to prohibit smoking in public places nationwide, the Commonwealth Attorney General reportedly said. *See The Age*, January 1, 1994.

CANADA

- [48] Proposed Antismoking Policy for Ottawa Outdoor Stadiums

The Ottawa City Council is reportedly considering an antismoking bylaw which would ban smoking in seating areas of open-air stadiums. According to a press report, the proposal was to be considered at a meeting of the council on January 20, 1994, where public comment was invited. *See The Ottawa Citizen*, January 7, 1993.

MALAYSIA

[49] Government Seeks Assistance in Enforcing Smoking Ban

Health Ministry officials will reportedly meet soon with Housing and Local Government Ministry officials to discuss enforcement of the Control of Tobacco Product Regulations 1993 Act. The measure goes into effect in May 1994 and bans smoking in nearly all public places. The Health Minister Parliament Secretary says that the ministry needs help in enforcing the new law and has asked all local authorities to submit a list of all smoke-free public buildings in their jurisdiction. Violators of the new law will face fines of up to M\$5,000 or a maximum of two years in jail. See *The Straits Times*, January 4, 1993.

NORWAY

[50] Smoking to be Banned in Schools

A press report indicates that by the year 1996, smoking will be banned in all of Norway's schools and kindergartens. Norway's ministry of education apparently hopes the ban will reduce the number of young smokers. See *Arbeiderbladet*, December 29, 1993.

UNITED KINGDOM

[51] Proposed Regulation on the Use of Air Conditioning and Mechanical Ventilation in Non-Domestic Buildings

Based on energy conservation concerns, a proposed regulation that includes among its provisions that air conditioning or mechanical ventilation systems be installed "only where they are reasonably necessary for the effective use of the building" was apparently released in draft form November 30, 1993.

With regard to ventilation rates, a Building Research Establishment (BRE) discussion paper on the proposal notes that currently, in the absence of smoking, a minimum rate of 8 liters per second per person is recommended by the Chartered Institute of Building Services Engineers. In smoking "zones," the current recommendation is for 30 liters per second per person, according to the Government Code of

Practice. The BRE paper notes that the latter situation "will require special provision."

The available draft documents do not suggest how the recommendation for higher ventilation rates where smoking is allowed might be reconciled with the suggested minimization of the use of mechanical ventilation in "non-domestic" buildings.

[52] Chief Medical Officer Issues "Challenge" For Healthier Lifestyle

According to a press report, the U.K. Department of Health's chief medical officer has issued a "challenge" to make a healthy new year's resolution and provided a list of suggestions, among them, "Protect your child from tobacco smoke -- particularly if you are pregnant," and "Give up smoking or set a date to stop." The "challenge" is described as a campaign that will include the distribution to pharmacies of over 1 million leaflets and 10,000 posters offering a list of twenty suggestions for improving one's health. See *U.K. Government Press Release*, December 31, 1993.

ETS-RELATED LITIGATION NOT INVOLVING THE TOBACCO INDUSTRY

AUSTRALIA

[53] Publicity Given to Confidential Settlement of ETS-Related Claim

Newspapers in Australia are reporting that a Melbourne woman in her early 30s received thousands of dollars after she threatened to sue a radio station where she alleged that she had been exposed to ETS and subsequently contracted pneumonia. Press reports indicate that the out-of-court settlement is subject to a confidentiality agreement, so little else is known about the case other than that the woman had spent time at the radio station attending lectures and tutorials.

Antismoking advocates are apparently hailing the settlement as a victory and say it should send a message to employers and owners of public places to ban smoking or face the possibility of facing litigation. They are also claiming that the settlement should extend the range of diseases for which nonsmokers can

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seek damages, calling pneumonia a "minor, temporary" condition. See *Herald-Sun*, *The Courier Mail*, *The Adelaide Advertiser*, *The Telegraph-Mirror*, *West Australian*, January 17, 1994.

**[54] Sydney Woman Claims Injury From ETS
Exposure in Nursing Home**

According to press reports, a Sydney woman is claiming that she suffered breathing problems as a result of exposure to ETS generated by patients in the nursing home where she worked. Although it has been reported that she is suing the nursing home, the case as yet is unfiled. See *Daily Telegraph-Mirror*, January 17, 1994; *Courier Mail*, January 18, 1994.

LEGAL ISSUES AND DEVELOPMENTS

UNITED KINGDOM

**[55] "Anti-Smokers to Turn Up the Heat," I.
MacKinnon, *Independent on Sunday*, January 2, 1994**

According to this article, ASH is planning to start a campaign to assist those who believe they have been harmed by ETS exposure in bringing actions for compensation against employers and the owners of public places such as pubs and restaurants. Stephen Woodward, formerly the director of ASH in Australia and now ASH deputy director in the U.K. is quoted as saying, "Until now we have adopted a 'softly softly' approach. We have tried the carrot and now we are going to use the stick."

ASH says it plans to back efforts to have employers prosecuted under the Health and Safety at Work Act for "failing to provide a risk-free environment," and to encourage actions for negligence against pub and restaurant owners. The author notes that ASH believes the threat of substantial compensation payments will force business owners to ban smoking on their premises. Some 85 percent of firms in the U.K. now reportedly have smoking restrictions in place and more than 35 percent ban smoking altogether. Woodward reportedly says that "progress" in this regard has been too "slow."

OTHER DEVELOPMENTS

UNITED KINGDOM

**[56] Doctors Polled Say Smoking Should Be Banned
in Pubs**

According to the reported results of a recent survey, four out of five physicians say they believe smoking should be banned in pubs, restaurants, public transport and in the workplace. The survey, administered to more than 900 doctors, was reportedly sponsored by the British Medical Association's *News Review* and is said to reflect the growing belief among doctors that smoking should be made illegal. Other topics covered in the survey included tobacco taxation and advertising. On such subjects, MP and ASH chairman Jerry Hayes was quoted to say, "A ban on tobacco advertising is now inevitable but one on smoking in public places is unlikely," because "people stop smoking by example, not by compulsion." See *Daily Mail* and *The Times*, January 4, 1994.

MEDIA COVERAGE

INDIA

**[57] "Rural Indian Women Victims of Domestic Air
Pollution," *The Xinhua General Overseas News
Service*, January 12, 1994**

According to this article, more than 90 percent of households in rural India use wood, dung and crop residues as fuel, and cooking is done in an open kitchen range known as a chulha. Typically, the ventilation is poor. Respiratory diseases are a leading cause of death among females in India, according to the article, which estimates that these women are exposed to "more pollution than industrial workers in highly polluted environments."

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APPENDIX A

The numbers assigned to the following article summaries correspond with the numbers assigned to the synopses of the articles in the text of this Report.

LUNG CANCER

- [36] "Dietary Beta Carotene and Lung Cancer Risk in U.S. Nonsmokers," S.T. Mayne, D.T. Janerich, P. Greenwald, S. Chorost, C. Tucci, M.B. Zaman, M.R. Melamed, M. Kiely, and M.F. McKneally, *Journal of the National Cancer Institute* 86(1): 33-38, 1994

"To our knowledge, no studies to date have specifically examined the association between dietary factors and lung cancer risk in nonsmoking men. Consequently, we conducted this study to examine the association of dietary beta carotene with lung cancer risk in a relatively large number of nonsmoking men and women."

"A population-based, individually matched case-control study of lung cancer in nonsmokers was conducted in New York State from 1982 to 1985."

"To be included as a case subject in the study, a patient had to reside in the 23-county region, be between 20 and 80 years of age, never have smoked more than 100 cigarettes (nonsmoker), or have smoked at some time but not have smoked more than 100 cigarettes in the 10 years prior to diagnosis (former smoker)."

"With regard to confounding, several potential confounders (type of interview, smoking history, sex, county of residence, and age) were matched by design and thus were not included in the logistic models. Passive smoke exposure was quantified as previously described and was examined as a potential confounder by inclusion of the following summary variables in logistic models: household exposure during childhood and adolescence (<21 years of age), household exposure during adulthood, lifetime household exposure, smoker-years of exposure from a spouse, and pack-years of exposure from a spouse. None of the passive smoking variables were found to confound the dietary associations; thus, these variables were not included in the final models. The final multivariate models included the following potential confounders: body mass

index, education, income, religion, and number of cigarettes smoked per day in former smokers. Use of cigars and pipes did not differ in case patients versus control subjects; thus, no adjustment was necessary for cigar/pipe use."

"Regarding the consumption of individual food items, case patients consumed significantly more whole milk and beer. Case patients, however, consumed significantly less of the following food items: tomatoes; greens (defined as all cooked greens and all salad greens except lettuce); fresh fruit other than peaches, apricots, or plums; skim or low-fat milk; cheeses, excluding ricotta, cottage, or cream cheese; and supplemental vitamin E."

"Consumption of greens, fresh fruit, and hard cheese was associated with a statistically significant dose-dependent reduction in risk, whereas consumption of whole milk was associated with a statistically significant, dose-dependent increase in risk for lung cancer."

"Ever use of vitamin E supplements was reported by 21.2% of the control subjects (86 of 406) versus 14.7% of the case patients (60 of 409). The OR for vitamin E supplements was 0.55 (95% confidence interval [CI] = 0.35-0.85) based on a case-control difference of 1 frequency unit/d."

"Subsequent analyses focusing on groups of related foods showed that increased consumption of the following food groups was associated with a statistically significant reduction in risk in females: vegetables, raw fruits and vegetables, and dairy products."

"In separate analyses, both raw fruits (adjusted OR = 0.64; 95% CI = 0.46-0.87) and raw vegetables (adjusted OR = 0.60; 95% CI = 0.38-0.95) were found to be significantly inversely associated with lung cancer risk."

"Beta carotene (OR = 0.70; 95% CI = 0.50-0.99), but not retinol (OR = 0.98; 95% CI = 0.82-1.17), was significantly inversely associated with lung cancer risk. . . [T]he highest quartile of intake of beta carotene was associated with a significant reduction in risk relative to the lowest quartile of intake (adjusted OR = 0.54; 95% CI = 0.30-0.98; data not shown)."

"This is the largest study to date to examine the association between dietary factors and lung cancer risk in nonsmokers. Our results indicate that consumption of fruits and vegetables, especially those consumed raw, is associated with a reduced risk for lung cancer. The

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apparent protective effect of raw fruits and vegetables did not vary by type of interview, smoking history, sex, or age. The magnitude of the protective effect for fruits and vegetables was greatest for epidermoid carcinomas."

"Our results in this study suggest that fruits and vegetables typically consumed in a raw form confer greater protection than those typically processed in some manner. This observation could be explained by the fact that cooking has been shown to destroy carotenoids."

"The data suggest that dietary beta carotene, which is almost exclusively derived from the intake of fruits and vegetables, also reduced the risk of lung cancer (OR = 0.70; 95% CI = 0.50-0.99)."

"In the comparison of the consumption of individual food items by case patients and control subjects, a striking difference was found for milk consumption: Case patients consumed significantly more whole milk and significantly less skim or low-fat milk than their matched control subjects. The magnitude of the case-control difference in consumption of whole milk and skim or low-fat milk exceeded that of all other food items. . . . It is possible that the association between whole-milk consumption and lung cancer risk reflects an effect of dietary fat, since other studies have reported that dietary fat increases the risk of lung cancer. . . . The apparent protective effect of dairy products in women, but not in men, may reflect the fact that women consumed more cheese and skim or low-fat milk but less whole milk than men."

"The primary strengths of this study are the relatively large number of nonsmoking case patients studied, the inclusion of both males and females, and the population-based design. Also, efforts were made to identify and interview subjects rapidly, minimizing the need for surrogate respondents."

"A major limitation of this study, however, is that the questionnaire used did not inquire about the overall diet. Consequently, our data do not allow for an assessment of other dietary factors including high intake of fat and low intake of vitamin E as risk factors for lung cancer in nonsmokers."

"Our finding of an association between consumption of fruits and vegetables (especially raw fruits and vegetables) and of beta carotene and a reduced risk for lung cancer in nonsmokers suggests that public health efforts to increase the consumption of fruits and

vegetables are likely to benefit both smokers and nonsmokers via a reduction in lung cancer risk. In addition, the apparent reduction in risk for lung cancer among vitamin E supplement users is a provocative finding and merits further examination."

RESPIRATORY DISEASES AND CONDITIONS — ADULTS

[37] "Asthma Related to Occupational and Ambient Air Pollutants in Nonsmokers," J.R. Greer, D.E. Abbey, and R.J. Burchette, *Journal of Occupational Medicine* 35(9): 909-915, 1993

"We attempted to determine the association between occupational and air pollutant exposure with the development of adult asthma through the analysis of a standardized respiratory questionnaire administered to a cohort of 3914 nonsmoking adults in 1977 and again in 1987. Ambient air pollution concentrations were estimated over a 20-year period using monthly interpolations from fixed-site monitoring stations applied to zip code locations by month of residence and work site."

"The variable 'Years Worked with a Smoker through 1987' (YWS87) contained a confidence interval that excludes one. Interestingly, 'Obstructive Airways Disease Before Age Sixteen' (AODB16) is significant with a relative risk (RR) of 4.24. Even though the relative risk (RR = 1.31) for mean ozone concentration exposure through 1987 approaches statistical significance, the confidence interval does include one. The variables 'Years of Occupational Dust Exposure,' 'Years of Occupational Vapor Exposure,' 'Cumulative Occupational Asthmagenic Substance Exposure,' and ambient mean TSP concentration all failed to reach .10 level of significance."

"Further sex-specific analysis revealed a statistically significant relative risk for ozone in men of 3.12, but ozone was not significant at the .05 level in women. YWS87 and AODB16 remained significant in both genders, with relative risks of 1.46 and 7.01 for men and 1.50 and 3.36 for women, respectively."

"Due to the small number of incident cases of asthma (84) and the small number of people reporting exposures other than environmental tobacco smoke (ETS) (661, 16.9% of the population), the power for detect-

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ing a relative risk greater than 1.5 for asthmagenic occupational exposures is less than 50%. Thus we cannot conclude that a lack of statistical significance for other occupational exposures indicates a real lack of association."

"In this population, ETS in the workplace is associated with the development of adult-onset asthma in both men and women. In fact, it is consistently associated with each of the asthma outcomes considered. ETS was the strongest occupationally related predictor of new onset asthma. . . . Relative risks associated with ETS reported here are consistent with those reported elsewhere."

"Long-term exposure to ozone was strongly associated with adult-onset asthma in men (RR = 3.12) for a 1 part per hundred million (pphm) incremental annual increase in mean concentration but not in women (RR = .94) in this population."

"Interestingly, TSP, which has been implicated in the genesis of asthma in other studies, was not a significant factor in the presence of ozone in this population."

"In summary, workplace ETS is by far the most common preventable asthmagenic exposure in this population. This has practical public health implications due to the high prevalence of workplace ETS in this country. ETS is not as well recognized in the occupational setting as a potential respiratory irritant as many other less frequently encountered occupational exposures. A previous history of respiratory disease or symptoms strongly predicts the development of asthma. Common sense would suggest that these workers should avoid occupations associated with respiratory exposures including ETS and ambient air pollutants."

RESPIRATORY DISEASES AND CONDITIONS — CHILDREN

- [38] "Risk Factors for Acute Wheezing in Infants and Children: Viruses, Passive Smoke, and IgE Antibodies to Inhalant Allergens," A.L. Duff, E.S. Pomeranz, L.E. Gelber, G.W. Price, H. Farris, F.G. Hayden, T.A.E. Platts-Mills, and P.W. Heymann, *Pediatrics* 92(4): 535-540, 1993

"The purpose of the present study was to examine the relationship of sensitization to inhaled allergens, viral infection, and passive smoke exposure in a nonselected population of infants and children treated

for wheezing in a pediatric emergency department. An additional objective was to determine at what age IgE antibody to inhalant allergens in these children can be demonstrated as a risk factor for wheezing."

"Among wheezing patients under age 2, IgE antibody to inhaled allergens was uncommon. This finding is consistent with prospective studies of infants born to allergic parents . . . In our study, none of the young wheezing patients younger than 2 years of age had signs or symptoms of atopic dermatitis."

"An increased prevalence of IgE antibody to inhalant allergens was evident in wheezing patients after age 2 years, and a significant association between wheezing and sensitization was observed after age 4 years."

"Altogether, viral infections put children both less than and more than the age of 2 at significant risk for wheezing. . . . Our data from wheezing patients less than 2 years of age support the importance of RSV as a major respiratory pathogen for wheezing in infants. None of the virus-infected children less than age 2, however, had IgE antibody to inhaled allergens."

"The prevalence of tobacco smoke exposure at home was high for wheezing and control patients. Before the age of 2, however, a larger proportion of wheezing patients than controls were exposed to tobacco smoke. Studies of smoking trends in the United States indicate that rates of cigarette smoking are higher among lower socioeconomic groups. Consistent with this, the income status of our patients, judged by the proportion of the emergency department bill charged to parents, was lower for the wheezing children less than age 2 than for controls. Similarly, the income status for all smoke-exposed patients was lower than for nonexposed patients."

"The most striking finding regarding passive smoke exposure was the large proportion of children less than age 2 years who had elevated cotinine levels suggestive of heavy smoked exposure. . . . [W]e speculate that infants and young children, who are likely to be more physically dependent on their parents, may have a higher risk for heavy exposure if their parents smoke. However, a threshold level at which passive smoke exposure becomes clinically significant in causing or aggravating airway hyperresponsiveness has not yet been defined. In addition, when combined with other risk factors, the effects of smoke inhalation may be additive so that lower levels of exposure may have adverse consequences even for older children."

- [39] "Influence of Maternal Smoking on Variability of Peak Expiratory Flow Rate in School Children," T. Frischer, J. Kuhr, R. Meinert, W. Karmaus, and R. Urbanek, *Chest* 104(4): 1133-1137; 1993

"Determination of the variability of the peak expiratory flow rate (PEFR) by serial measurements of PEFR has been proposed as a simple and useful screening method for asthma in population-based studies. The variability of the PEFR is highly correlated with nonspecific bronchial hyperresponsiveness. We measured the variability of the PEFR in a population-based sample of 1,237 children aged 7 years, in order to study the relationship between the variability of the PEFR and exposure to maternal smoking."

"This report is based on a longitudinal cohort study of the natural history of asthma and allergies in childhood currently being conducted in southwestern Germany."

"An association between baseline pulmonary function and maternal smoking status was not observed."

"Children with respiratory symptoms during the week demonstrated increased diurnal PEFR variability more often than healthy children."

"The incidences of variables of interest in tertiles of PEFR variability are shown. Current maternal smoking was significantly more frequent in the highest tertile. There was also a nonsignificant trend for paternal smoking. The number of smoking parents in the household was significantly related to PEFR variability."

"For nonasthmatic children, maternal smoking was associated with a 13.7 percent higher PEFR variability (CI, 2.8 to 24.7 percent). For asthmatic children without atopy, PEFR variability was 54.7 percent higher (CI, 5.5 to 226.8 percent), whereas in atopic asthmatic children, PEFR variability was -8.5 percent (CI, -41.2 to 42.3 percent) lower when maternal smoking was reported."

"To the best of our knowledge, we demonstrated for the first time that maternal smoking can substantially increase the variability of the PEFR in school children."

"In our analyses, for the subgroup of asthmatic children (but not for nonasthmatic children), a negative interaction between maternal smoking and atopy was significant, suggesting that while both risk

factors are associated with increased PEFR variability, their combination is not. This would tempt one to believe that there is no effect of maternal smoking on PEFR variability in atopic asthmatic children."

"Our data suggest that both atopy and maternal smoking can increase PEFR variability among asthmatic children but do not act independently, since the proportion of children being exposed to passive smoke decreases with increasing severity of the atopic disease. Negative findings in the literature regarding the impact of maternal smoking on respiratory health of children might be explained by such an effect."

"The mechanism by which passive smoking might increase bronchial responsiveness is still unclear."

"The assessment of exposure to passive smoke was fairly crude in our study, possibly leading to an underestimation of harmful effects. Nevertheless, our findings support the hypothesis that maternal smoking contributes to increased PEFR variability and thus to the development of asthma in childhood."

- [40] "Environmental Tobacco Smoke and Asthma," S.T. Weiss, *Chest* 104(4): 991-992, 1993

"The article by Frischer et al on maternal smoking and peak flow variability in this issue of *Chest* is notable both for its subject matter and its methods."

"The ability of Frischer and coworkers to demonstrate significant correlations of peak flow variability with maternal smoking is likely to stimulate further research on peak flow monitoring as an important area of asthma investigation."

"With regard to results, the association of maternal cigarette smoking with peak flow variability demonstrated by Frischer et al highlights the importance of maternal cigarette smoking in relation to asthma incidence and severity."

"[T]here is no question that maternal cigarette smoking is an important exacerbating factor in established disease."

"Three things remain unclear: Does maternal cigarette smoking influence the development of asthma? What is the relative importance of pre- versus post-natal exposure? What is the mechanism by which maternal smoking exerts its effects?"

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"In considering mechanisms and susceptible subgroups, the data are conflicting, at best. . . . Frischer and coworkers support a nonatopic mechanism, as their positive association was confined to nonatopic subjects."

"[T]here is a growing body of evidence suggesting that maternal cigarette smoking, either *in utero* or during the first year of life, is associated with the development of asthma."

"The gradual, but significant, increase in childhood asthma prevalence and hospitalization in the United States coincides with a doubling of cigarette smoking rates among women of child-bearing age in this country. Roughly 50 percent of all children under the age of 5 years are exposed to cigarette smoking either pre- or postnatally. We need to determine the role of maternal smoking in the onset of childhood asthma, and further research is clearly needed to accomplish this goal."

[41] "Children's Exposure to Parental Smoking in West Germany," H. Brenner and A. Mielck, *International Journal of Epidemiology* 22(5): 818-823, 1993

"In this paper, we develop and employ an indirect method for deriving estimates of the prevalence of children's exposure to parental smoking from information on active smoking habits, and family and living conditions of adults in the Federal Republic of Germany (FRG)."

"Among children aged 6-13 living in the same household as their father, almost 50% were exposed to paternal smoking. This proportion decreased to 43.1% and 33.7% among 2-5 year old and 0-1 year old children. . . . There was a striking variation of exposure to paternal smoking by level of school education of the father; paternal smoking prevalence varied between 73.8% for the 6-13 year olds whose father had 9 years school education and 23.5% for children of the same age group with better-educated fathers."

"Overall, the prevalence of maternal smoking was considerably lower than the prevalence of paternal smoking, although almost one-third of the children aged 2-13 were exposed to maternal smoking. Again, there were striking differences by level of maternal school education: prevalence of exposure to maternal smoking was almost twice as high among 6-13 year old children of less-educated women (39.7%) compared to children of better-educated women (20.6%)."

"About 60% of the 0-1 year old children and more than two-thirds of the 6-13 year old children were exposed to at least one smoking household member, and about one-third of the children in each of the three age groups was exposed to at least two smoking household members."

"A limitation of our approach is that the quantification of parental smoking is based on self-reported active smoking habits of the parents rather than precise measures of children's inhalation of sidestream tobacco smoked (e.g. by biological markers). . . . As underreporting of active smoking is more likely than overreporting in health surveys, the true prevalence of parental smoking and average numbers of cigarettes smoked per day by smoking parents are likely to be even higher than estimated in this study."

"Another limitation is the potential for selection bias as reflected in the overall response rate of only about 66%."

"Maternal smoking prevalence was somewhat lower for children aged 0-1 than for older children. Although this may reflect high quit rates during pregnancy followed by high relapse rates in the years following childbirth, the fact that a similar pattern was observed for paternal smoking supports the possibility of the beginning of a secular trend towards lower parental smoking rates. A definite answer to this question is not yet possible with currently available data."

"[T]he high prevalence of exposure to parental smoking in Germany implies that a large proportion of respiratory diseases among children, including such severe conditions as childhood asthma, is likely to be due to parental smoking and should therefore be preventable by reducing smoking among parents. It should be noted that the associations reported in epidemiological studies could substantially underestimate the true associations due to inaccuracies in reporting smoking habits, particularly as one might suspect underreporting of smoking in parents with symptomatic children in many studies."

[42] "Predicting Regional Lung Deposition of Environmental Tobacco Smoke Particles," W.W. Nazaroff, W.-Y. Hung, A.G.B.M. Sasse, and A.J. Gadgil, *Aerosol Science and Technology* 19: 243-254, 1993

"To improve our understanding of the risk of ETS exposure, it is important to know the size distributions

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of ETS particles that deposit in different regions of the respiratory tract. This paper presents a method for predicting regional deposition of ETS particles in human lungs. The method combines experimental data on ETS particle emission profiles with two existing mathematical models: an indoor aerosol dynamics model and a lung deposition model. The paper describes the method and illustrates its application by predicting lung deposition of ETS particles for a selection of residential exposure conditions. The method should be useful in two applications: assessing risk of ETS exposure under varying conditions; and evaluating the effectiveness of control measures."

"Interpretation of particle size distribution measurements after cigarette combustion by a smoking machine in a test room yields an effective emissions profile. An aerosol dynamics model is used to predict indoor particle concentrations resulting from a specified combination of smoking frequency and building factors. By utilizing a lung deposition model, the rate of ETS mass accumulation in human lungs is then determined as a function of particle size and lung airway generation. Considering emissions of sidestream smoke only, residential exposures of nonsmokers to ETS are predicted to cause rates of total respiratory tract particle deposition in the range of 0.4-0.7 ug/day per kg of body weight for light smoking in a well-ventilated residence and 8-13 ug/day per kg for moderately heavy smoking in a poorly ventilated residence. Emissions of sidestream plus mainstream smoke lead to predicted deposition rates about a factor of 4 higher."

"The method proposed here comprises two major stages. In the first stage, an indoor aerosol dynamics model is used to predict the indoor airborne particle size distribution as a function of time. The key input data are as follows: the particle emissions profile from a cigarette; the temporal pattern of smoking; the volume of the building; the ventilation rate; and, if an air filter is active, the filtration rate and efficiency. In the second stage, a lung deposition model is used to relate the airborne particle size distribution to particle mass accumulation in an exposed individual. Key input data for this stage are the age, gender, and activity level of the exposed individual; these parameters determine the lung morphometry, breathing frequency, and tidal volume. The central output of the model is a prediction, for each generation of the respiratory tract, of the

mass of environmental tobacco smoke particles deposited over a specified time interval, segmented according to particle size."

"As presently formulated, the model components do not account for processes of evaporation and condensation which, in principle, may occur either in indoor air or within the respiratory tract."

"Our research group is presently applying this method to other environmental tobacco smoke exposure scenarios. We are giving particular attention to the potential for reducing exposure by local ventilation or by the use of portable air cleaners."

INDOOR AIR QUALITY

- [43] "Assessment of an Ultraviolet Air Sterilizer on the Incidence of Childhood Upper Respiratory Tract Infections and Day Care Centre Indoor Air Quality," J.C. Dionne, J.C. Soto, and S. Pineau, *Indoor Environment* 2: 307-311, 1993

"A double-blind trial was conducted to evaluate the effect of an ultraviolet air sterilizer [UVAS] in reducing the incidence of upper respiratory infections [URI] in children and the concentration of micro-organisms in 3 day-care centres [DCC] located in Montreal."

"The study was performed [in] the autumn of 1991 among young children attending 3 DCC located in the metropolitan area of Montreal. It has been documented that children under 36 months of age in day care are at high risk of developing URI, especially in autumn."

"Children exposed to UVAS experienced a 1.53 higher URI incidence rate than those who were not. However, this difference disappeared when controlling for the age of the children."

"In rooms A and B, there was a significant reduction in airborne bacteria after the installation of the room air sterilizer. The results for rooms C and D indicate no significant reduction."

"Before and after installation of the appliances, the indoor concentrations of fungal spores were higher than those outdoors (particularly in rooms A and C). There was no significant reduction in the counts after installation of the room air sterilizers, and, surprisingly, there was a lower fungal concentration in rooms where the UV lamps were off (rooms C and D, at 3 weeks)."

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"The present study showed that the efficiency of UVAS in reducing the density of airborne micro-organisms was inadequate in reducing illness in the subjects."

"Important factors that would not be controlled by UVAS include transmission by aerosol or dust and direct contamination from human contact (both children and personnel) during daily activities."

"UVAS does not offer protection against URIs, particularly in young children attending DCC. Moreover, the devices have little effect on the environmental concentration of micro-organisms. The best available measure to improve indoor air quality, which is also the least expensive, is by adequate ventilation, thus diluting any contaminants with outdoor air."

"In DCC, other routes of infection are probably most important and only a comprehensive public health programme can reduce the risk of infection and disease."

[44] "Air Quality Standards in Offices: Should They Be Health or Comfort Based?" F.W. Lunau, *Indoor Environment* 2: 213-216, 1993

"In very many countries, there exist legislation or other guidance governing the level of exposure to air contaminants to prevent untoward health effects in workers. These are different from general environmental air quality standards in that workers are recognised as reasonably fit adults, only exposed up to a predetermined retirement age, and their work pattern usually is such that they are generally exposed for 8 h in each 24-hour day for 5 days per week."

"Officer workers meet the above criteria, and therefore it seems reasonable to assume that by adherence to the above standards their health is adequately protected. Despite this, there is a considerable body of opinion that observance of the occupational exposure standards does not offer sufficient safeguard for the health of office workers."

"There are considerable practicable and indeed conceptual difficulties in the consideration of having different health-based exposure limits for office workers over those for other occupational groups when they all come from a common population."

"Whilst the subject is a very complex one, some elucidation can be gained by looking at the evidence cited in the determination of occupational exposure

limits and contrasting it with the evidence cited in support of possible office exposure limits."

"The question of the populations concerned, i.e. industrial or office, is one not often directly addressed. . . . Nevertheless, in much of the literature, there are implicit or explicit statements that the populations are different. One such publication is ASHRAE Standard 62-1989. . . . [T]he office population is a selected one akin to the industrial population. It is very far removed from the general population which contains the very young, the very old and the very sick, all of whom require a different standard of air pollution control to safeguard their health."

"The question must now be posed as to whether, for essentially similar populations, there should be different legally enforceable air pollution standards."

"In the absence of a real health-based reason for office standards being lower than for industrial premises, what other reasons can there be for using a different exposure standard, either legally enforceable or in the form of guidance? One important reason is that of expectation and perception of the quality of the indoor environment, which equate to comfort. . . . In the office situation, dissatisfaction with the indoor environment (which includes many factors other than the chemical quality of the indoor air) will have its main effect as an economic one in terms of lower productivity, greater absence and greater staff turnover. . . . Whatever the figure, the solution to the problem is a management one and not one to be solved by legislative control."

"In conclusion, there is no logic in having different health-based legislative standards for industrial and office workers. The latter will have higher expectations and perceptions regarding their indoor environment. Failure to meet these expectations will not lead to clinically observable ill health, but will have an effect, possibly a large effect, on economic cost. Improved guidance rather than regulation is the best way to resolve office indoor air quality problems."

[45] "Examination of Sick Leave Absences from Work in Buildings with Various Rates of Ventilation," D.M. Rowe, S.E. Wilke, and L. Guan, *Indoor Environment* 2: 276-284, 1993

"The symptoms of sick building syndrome closely resemble those of several specific minor ailments. As a

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preliminary to testing for a relationship between them and the rate of supply of outdoor air for ventilation, Rowe established in 1987 a database containing details of sick leave absence from work of sample populations of workers in four office buildings in or near Sydney, New South Wales, for the year January to December 1986."

"[B]uilding 1a is naturally ventilated. . . . Buildings 2 and 4 are air-conditioned."

"[B]uilding 3 is also of good quality and is well maintained."

"[B]uilding 6 was added as an example similar to 3."

"Building 5 was included as an example with year-round re-circulation of return air and the minimum rate of ventilation by outdoor air then permitted."

"It has never been suggested that these are 'sick' buildings, but complaints have been registered regarding thermal discomfort due to direct solar gain and radiant heat from sunlit windows in buildings 2, 3, 4 and 5."

"Records of date, length of absence in quarter-day increments and the nature of approved sick leave for the sample populations were recorded in six broad categories with several sub-classifications, including allergy and headache."

"Ventilation rates were calculated from design drawings, as access was not available to the authors to measure actual flow rates."

"No significant correlation was found between rates of supply of outdoor air for ventilation and rates of sick leave absence due to minor respiratory and other illnesses of some 500 workers in this sample of 7 office buildings. The highest absence rates for the year 1986 were reported from the group located in the one naturally ventilated building 1a in the study with even higher rates reported from the same group of people in 1990/1991 after a move to near-new air-conditioned premises (building 1b). The increase may be due to this move into air-conditioned premises, but that the absence rates are much higher in both buildings than those reported by any of the other groups suggests, however, that they are not necessarily building-related at all."

"Rates of absence due to minor respiratory illness such as colds, influenza, upper respiratory tract

infection and the like rose during winter months in all buildings. There does not, however, appear to be any notable relationship with ventilation rates."

"Although no correlation was found between the rates of supply of outdoor air for ventilation and sick leave absence rates, there were significant differences [sic] between those experienced by undifferentiated sample populations in the buildings which persisted over the 2 sample years. It would therefore appear that building-related factors were responsible, at least in part, for these differences."

"It has been estimated that a reduction of the average annual rate of minor sick leave absence of the estimated 2.5 million office workers in Australia by half a day per person per year would result in improved productivity worth some \$130 million. . . . It is suggested that investigation of aspects of the indoor environment in addition to ventilation by outdoor air are potentially fruitful and that such investigation should include simultaneously such factors as evaluation of the perceptions of the occupants, measurement of trace air contaminants, and detailed evaluation of installed service systems, finishes and furnishings."

"If further investigation confirms the absence of correlation between outdoor air ventilation rates and sick leave absence, it may be worthwhile to review current code requirements that have been revised upward in the recent past."

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APPENDIX B

UPCOMING SCIENTIFIC MEETINGS

- **February 14, 1994**
One-Day IAQ Course, Environmental Law and Policy Program, George Washington University, Washington, D.C. [Issue 63, Item 25] Same program to be held September 7, 1994
- **March 4, 1994**
Indoor Air Quality: An Overview for People Who Need to Know, AIHHM, San Antonio, Texas [Issue 57, Item 35] Same program to be held April 13, 1994, Minneapolis, Minnesota; May 5, 1994, Chicago, Illinois; June 17, 1994, Oklahoma City, Oklahoma; July 14, 1994, Anchorage, Alaska
- **March 22-24, 1994**
Indoor Environment '94, IAQ Publications and other sponsors, Washington, D.C. [Issue 61, Item 30]
- **March 28-31, 1994**
Eleventh ORNL Life Sciences Symposium, Indoor Air and Human Health Revisited (Bringing Selected Advances in Medical Science to the Indoor Air Quality Community), Knoxville, Tennessee [Issue 58, Item 43]
- **May 5-7, 1994**
Second Annual IAQ Conference and Exposition, NCIAQ, Tampa, Florida [Issue 49, Item 35]
- **May 22, 1994**
Indoor Air Quality Symposium, American Industrial Hygiene Conference and Exposition, Anaheim, California [Issue 57, Item 34]
- **August 22-25, 1994**
Healthy Buildings '94, Budapest, Hungary [Issue 63, Item 26]
- **October 10-14, 1994**
9th World Conference on Tobacco and Health, Paris, France [Issue 60, Item 38]
- **October 18-20, 1994**
Indoor Air Quality in Asia, Beijing, China [Issue 54, Item 42]
- **October 30-November 2, 1994**
IAQ '94: Engineering Indoor Environments, ASHRAE and other sponsors, St. Louis, Missouri [Issue 58, Item 42]

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ETS/IAQ REPORT

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